

TXU on Oct. 10, 2007. TXU/Luminant Mining reached an agreement with Alcoa to acquire its Three Oaks lignite mining assets and assume responsibility for mining operations to supply the Sandow electricity-generating units.

Texas Mine Safety and Health Program (<http://www.utexas.edu/cee/txmshp/>) has developed a Safety Update newsletter in an effort to reach those who might benefit from or have an interest in Texas mine safety. Objectives of the newsletter are to provide mining-related groups with current information on events that have recently happened or will happen in the near future, as well as safety advice. The newsletter is currently produced on a quarterly electronic-publication basis. ■

UTAH

R.L. BON and K.A. KRAHULEC, Utah Geological Survey

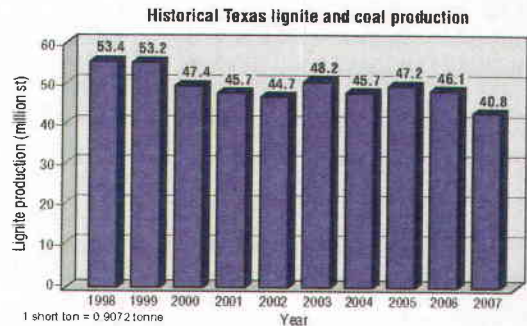
The gross value of all energy and mineral commodities produced in Utah in 2007 is about \$7.71 billion, slightly less than the record high of \$7.88 billion reached in 2006 (Fig. 1). The 2007 value is largely due to the lower production of metals despite higher prices for crude oil and a record value for industrial minerals.

The value of Utah's mineral production (including coal) in 2007 is estimated at a near-record \$4.64 billion (Fig. 2), \$40 million (less than 1 percent) lower than the revised value of \$4.68 billion for 2006. The only segment of Utah's mineral industry to show an increase in value was industrial minerals. Contributions from each of the mineral segments were: base metals, \$2.83 billion (61 percent of total); industrial minerals, \$921 million (20 percent of total); coal, \$574 million (12 percent of total); and precious metals, \$322 million (7 percent of total) (Fig. 2, Table 1). Compared to 2006, the 2007 values of base metals decreased \$58.1 million (2 percent), industrial minerals increased \$111 million (14 percent), coal decreased \$13.8 million (2 percent) and precious metals decreased \$79 million (20 percent).

Preliminary estimates from the U.S. Geological Survey (USGS) rank Utah fourth nationally in the value of nonfuel minerals produced in 2007, and Utah accounted for about 5.8 percent of the total U.S. nonfuel mineral production value (USGS, 2008). Utah ranked 12th (up

FIG. 4

Historical Texas lignite and coal production. Data from the Railroad Commission of Texas.



from 15th in 2005) in coal production in 2006 (Energy Information Administration, 2007) and will likely retain the same ranking for 2007.

Metal prices reached near-historic highs in 2007, climbing from the record lows reached in 2001-2002. This increase has led to substantially increased mineral exploration and development in Utah. In addition to the initiation of mining at the Lisbon Valley copper mine and the Pandora uranium mine, both in San Juan County, advanced-stage exploration and development is ongoing in the Iron Springs iron and Rocky Range-Beaver Lake copper-gold mining districts.

National rankings

Preliminary USGS data for 2007 shows that Utah remained the only state that produced beryllium concentrates and magnesium metal. Additionally, Utah continued to be second in the quantity of copper, molybdenum concentrates (first in 2006), potash, and magnesium compounds produced (in descending order of value); third in gold (second in 2006); fourth in phosphate rock and silver and fifth in salt. The state was also a significant producer of portland cement, construction sand and gravel, lime, common clays and gemstones (Tanner, USGS, written correspondence 2008).

The USGS's preliminary estimate of the value of nonfuel mineral production for 2007 was \$3.94 billion (Tanner, USGS, written correspondence, 2008), about \$30 million (1 percent) less than in 2006. USGS data show that between 2002 and 2007 the value of nonfuel mineral production in Utah increased from \$1.24 billion (a 10-year low) in 2002 to a record high \$3.97 billion in 2006 (Fig. 3). The Utah Geological Survey's (UGS) estimate for the value of nonfuel mineral production for 2007 is \$4.07 billion, compared to \$4.1 billion for 2006.

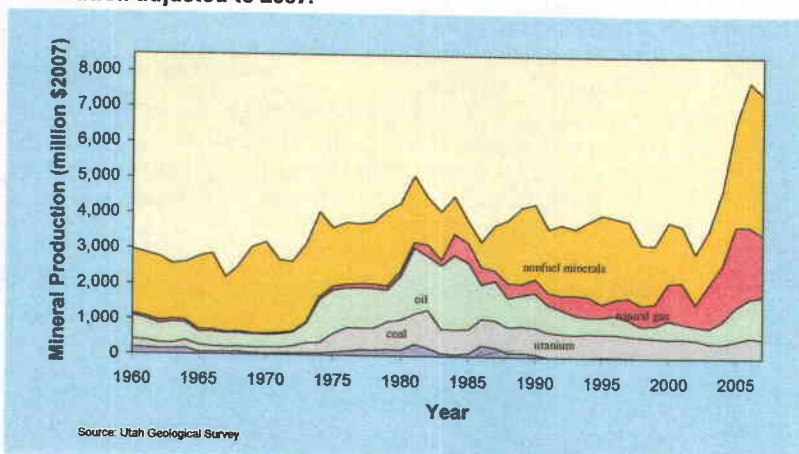
A summary of estimated mineral values by the UGS from 1998 through 2007 is shown in Table 1.

Base and precious metal production

Base metal production, with an estimated value of \$2.83 billion, was the largest contributor to the value of minerals produced

FIG. 1

Total annual value of Utah's energy and mineral production, 1960-2007, inflation adjusted to 2007.



in 2007 (Fig. 2, Table 1). In descending order of value, those metals were copper, molybdenum, magnesium and beryllium. The 2007 base metal value was about \$58 million (2 percent) less than 2006. It is the first decrease in base-metal value since 2002. Precious metal production, valued at \$322 million (Fig. 2; Table 1), includes gold (85 percent of total value) and silver (15 percent of total value). Precious metal values in 2007 were \$79 million (20 percent) lower than in 2006—the first decrease in precious metal value since 2003.

Kennecott Utah Copper's (KUC) Bingham Canyon Mine, located about 32 km (20 miles) southwest of Salt Lake City in Salt Lake County, is the state's major producer of copper, gold and silver, and its sole producer of molybdenum. The combined value of minerals produced from the Bingham Canyon Mine in 2007 was about 63 percent of the total value of all minerals produced statewide. KUC is in the fourth year of an aggressive mine life extension program.

Copper

Copper was the largest contributor to the value of nonfuel minerals in Utah. Substantial price increases, which began in 2003, raised the value of copper produced to a near all-time high, and the value of base metal production statewide to nearly \$2.83 billion. The Bingham Canyon Mine produced about 211 kt (233,000 st) of copper in 2007, compared to the 268 kt (296,000 st) produced in 2006. However, Rio Tinto stated that smelter and refinery production was 21 percent higher in 2007 compared to 2006 when major scheduled maintenance was undertaken on the smelter (Rio Tinto, 2008).

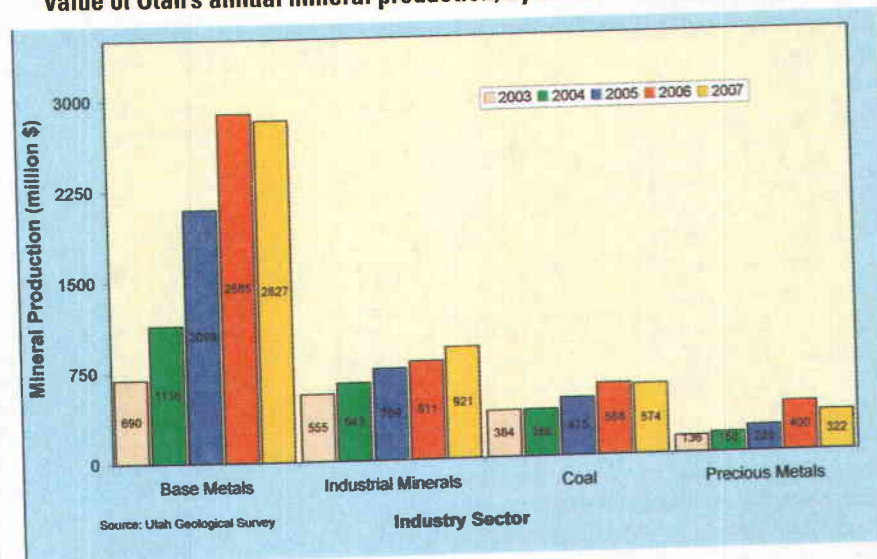
The Lisbon Valley copper mine, located 72 km (45 miles) southeast of Moab in San Juan County, began operating in December 2005, but the solvent extraction-electrowinning (SX-EW) circuits did not start up until April 2006. The plant produced about 9.1 kt (10,000 st) of copper in 2007. Production will likely decrease in 2008 as the mine strives to reduce costs. Mining has been curtailed, but leaching will continue until the ore pad has been depleted.

Molybdenum

Molybdenum was the second largest contributor to the value of Utah's base metal production in 2007. Kennecott's Bingham Canyon Mine produced about 14.9 kt (16,400 st) of coproduct molybdenum in 2007, compared to 16 kt (18,000 st) produced in 2006. Rio Tinto reported that production of molybdenum was 11 percent lower than 2006 as a result of lower ore grade and high limestone levels in the orebody (Rio Tinto, 2008). The decreased production of molybdenum was largely offset by a 26-percent increase in molybdenum metal prices during the year. The USGS reported that the Bingham Canyon Mine was one of five domestic copper mines to recover molybdenum as a byproduct. The USGS also reported that the total U.S. mine output of molybdenum in concentrate decreased slightly in 2007 (Magyar, 2008).

FIG. 2

Value of Utah's annual mineral production, by sector from 2003 to 2007.



Gold and silver

Gold production in 2007 was estimated to be about 12.4 t (400,000 oz), about 3.1 t (100,000 oz) less than in 2006. Gold is produced from two surface mines owned by Kennecott. One primary producer (Barneys Canyon Mine) and one byproduct operation (Bingham Canyon Mine) are located in Salt Lake County. Several other small mines in the state are known to produce minor amounts of gold and silver, but production is not reported nor included in the above totals. The Barneys Canyon Mine exhausted its economic ore reserves in late 2001 and ceased mining. But it continued to produce gold from its heap leach pads at a reduced rate into mid-2008 when those pads will be depleted. Silver is also a byproduct metal from the Bingham Canyon Mine. Silver production was about 112 t (3.6 million oz) in 2007 compared to more than 131 t (4.2 million oz) in 2006.

Magnesium

Magnesium metal was the third largest contributor to the value of base metals in 2007. Magnesium metal is produced from Great Salt Lake brines by US Magnesium at its electrolytic plant at Rowley in Tooele County. The plant's annual capacity is 43 kt (47,000 st) of magnesium metal (99.8 percent purity). It is the only active primary magnesium processing facility in the U.S.

Magnesium production in 2007 was moderately higher than in 2006. Average magnesium metal prices increased from \$3.09/kg (\$1.40/lb) in 2006 to \$4.41/kg (\$2/lb) in 2007 (Kramer, 2008).

Beryllium

Utah continued to be the nation's sole producer of beryllium concentrates. Brush Resources has a beryllium (bertrandite) mine in Juab County. Ore and imported beryl can both be processed through parallel circuits at the company's plant a few miles north of Delta in Millard County. The product (beryllium hydroxide) is then sent to the company-owned refinery and finishing plant in Elmore, OH, where it is converted into beryllium metal, alloys and oxide. The company reported mining approximately 58 kt (64,000 st) in 2007, in addition to processing

about 1.1 kt (1,200 st) of imported beryl ore. The company's Monitor pit will close in 2008 and production will begin at the new Fluro-Roadside pit.

In 2005, Brush Engineered Materials (the parent company) was awarded a \$9-million contract under the Department of Defense's Defense Production Act, Title III Program. The contract is for the engineering and design of a new

facility for the production of primary beryllium, the feed-stock material used to produce beryllium metal products. The new facility, to be owned and operated by Brush Engineered Materials, will be located at an existing plant site in Elmore, OH. The company anticipates that the design and engineering will be completed and construction could begin in 2008.

Industrial minerals production

Industrial minerals production, with an estimated value of \$921 million (an all-time high) was the second largest contributor to the value of minerals produced in 2007 (Fig. 2, Table 1) and was the only segment of Utah's mineral industry to show an increase in value. The value of industrial minerals has grown substantially during the past 10 years, increasing from \$534 million in 1998 to \$921 million in 2007, a 72-percent increase.

Commodities or commodity groups that have realized the majority of these gains include sand and gravel and crushed stone; portland cement and lime; salines, including salt, magnesium chloride, potash (potassium chloride) and sulfate of potash (SOP), and phosphate rock. These commodities accounted for 89 percent of the total value of Utah's industrial minerals segment.

Other commodities produced in Utah, in descending order of value, include gilsonite, expanded shale, gypsum, common clay, bentonite and kaolinite. While the overall value of industrial minerals reached a record high, several commodity groups, including portland cement, phosphate, expanded shale, clay and bentonite experienced lower values due to lower production and/or lower commodity prices in 2007.

Sand and gravel and crushed stone

Sand and gravel, and crushed stone (including limestone and dolomite) were the largest contributors to the value of industrial minerals produced in Utah during 2007, with an estimated value of \$318 million, about \$99 million (45 percent) higher than in 2006. These materials are produced in

Table 1

Utah estimated mineral production values in nominal dollars by industry segment from 1998 through 2007, value is in millions. Note that totals may not equal the sum of individual parts due to rounding.

Year	Base metals	Industrial minerals	Coal	Precious metals	Total value
1998	\$688	\$534	\$474	\$154	\$1,850
1999	\$626	\$583	\$460	\$153	\$1,822
2000	\$749	\$500	\$456	\$212	\$1,916
2001	\$693	\$538	\$480	\$240	\$1,951
2002	\$612	\$565	\$467	\$172	\$1,815
2003	\$690	\$555	\$384	\$136	\$1,765
2004	\$1,136	\$643	\$386	\$158	\$2,324
2005	\$2,093	\$759	\$475	\$209	\$3,536
2006	\$2,885	\$811	\$588	\$400	\$4,684
2007	\$2,827	\$921	\$574	\$322	\$4,644

nearly every county in Utah by commercial operators as well as county, state and federal agencies.

Due to the large number of operations (approximately 140 active pits and quarries), the UGS does not send production questionnaires to this group. However, production data are compiled by the USGS. Based on preliminary 2007 data (Tanner, 2008), the USGS estimated that 2007 production will be 41.3 Mt (45.5 million st) of sand and gravel with a value of \$211 million, and 16 Mt (17.6 million st) of crushed stone with a value of \$107 million. Crushed stone production includes raw materials for lime and cement plants. This is a 9-percent increase in sand and gravel production and a 63-percent increase in the production of crushed stone compared to 2006.

Salt, magnesium chloride, potash (potassium chloride) and sulfate of potash

Brine-derived products, including salt, were the second-largest contributors to the value of industrial mineral production in Utah during 2007, with a combined value of \$247 million, about \$14 million (6 percent) more than in 2006. In addition to salt, brine-derived products include magnesium chloride and potash (potassium chloride and potassium sulfate). One company (North Shore Limited Partnership) produces a small amount of concentrated

FIG. 3

Total annual value of Utah's nonfuel mineral production from 1998 through 2007.

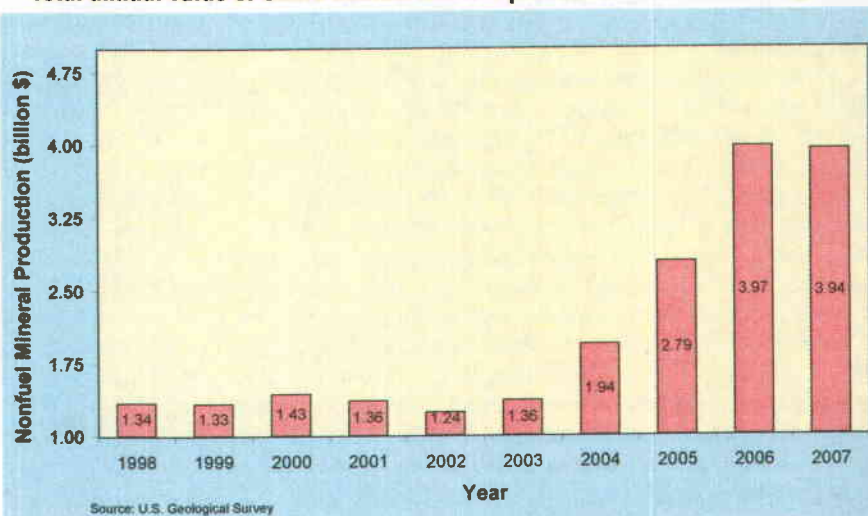
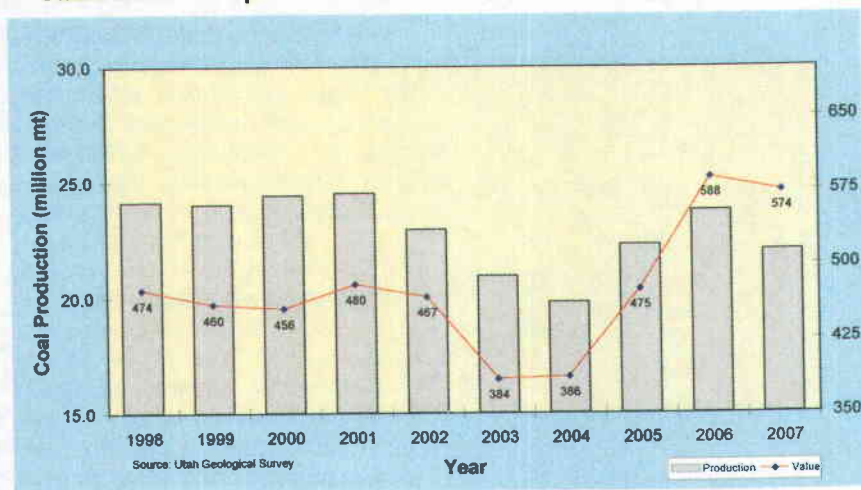


FIG. 4

Utah's annual coal production and value from 1998 through 2007.



magnesium brine that is used as an ingredient in mineral food supplements. The statewide production of salt and other brine-derived products, excluding magnesium metal, was estimated to be 3.26 Mt (3.59 million st) in 2007, slightly less than in 2006. Potash production (including SOP) was estimated to be about 360 kt (400,000 st) in 2007, approximately 200 kt (220,000 st) less than in 2006.

Salt production alone was estimated to be 2.49 Mt (2.75 million st) in 2007, about the same as 2006. Most of the production came from three operators processing brine from Great Salt Lake. The three largest operators are, in descending order of production; Great Salt Lake Minerals, Cargill Salt and Morton International. In addition, three other companies produce salt and/or potash from operations not located on Great Salt Lake. They are Reilly Chemical at Wendover in Tooele County (salt and potash); Moab Salt near Moab in Grand County (salt and potash), and Redmond Minerals near Redmond in Sanpete County (rock salt). In the past five years, Redmond Minerals has increased production significantly as the result of an aggressive marketing campaign.

Portland cement and lime

Portland cement and lime were the third largest contributors to the value of industrial minerals produced in 2007, with a combined value of \$236 million, about \$2 million (1 percent) less than in 2006. Two operators produce portland cement in Utah: Holcim and Ash Grove Cement Co. Holcim's Devils Slide plant and mine are located east of Morgan in Morgan County and Ash Grove's Leamington plant and mine are east of Lynndyl in Juab County. The companies have a combined capacity of more than 1.4 Mt (1.5 million st) of cement annually. Both plants operated at or above capacity in 2007, with total production of about 1.5 Mt (1.7 million st). In addition to limestone, Ash Grove Cement mines a modest amount of shale and sandstone that are used in the manufacture of cement.

Lime production was about 5 percent higher in 2007 than in 2006, with an estimated production of about 853 kt (940,000 st). There are two suppliers of lime in Utah, with a combined capacity of more than 900 kt/a (1 million stpy). Graymont Western U.S., produces dolomitic quick lime. And high-calcium quick lime, and Chemical Lime

of Arizona, produces dolomitic quick lime and hydrated dolomitic lime. Both operations serve markets in Utah and surrounding states. Graymont Western's plant is in the Cricket Mountains, approximately 56 km (35 miles) southwest of Delta in Millard County. It is one of the 10 largest lime plants in the United States. The addition of a fifth kiln to Graymont's Cricket Mountain plant will add about 500 kt/a (551,000 stpy) of capacity. Chemical Lime of Arizona's plant is about 13 km (8 miles) northwest of Grantsville in Tooele County.

Statewide, DOGM lists 34 active limestone operations including 18 large mine and 16 small mine permits. Total limestone production reported in 2007 was 5.1 Mt (5.6 million st). Other uses of limestone include construction as well as fluegas desulfurization in coal-fired power plants. A small amount of limestone is also crushed to a fine powder and marketed as "rock dust" to the coal mining industry.

Phosphate

Simplot Phosphates is Utah's only phosphate producer. The company's phosphate operation is 18 km (11 miles) north of Vernal in Uintah County. The mine produces roughly 2.7 to 3.6 Mt (3 to 4 million st) of ore annually, which is processed into 970 kt to 1.8 Mt (1 to 2 million st) of phosphate concentrate. The concentrate is transported in slurry form to the company's Rock Springs, WY fertilizer plant by a 144-km (90-mile) underground pipeline. During 2007, the mine produced about 3.4 Mt (3.7 million st) of ore, slightly less than in 2006.

Gilsonite

Gilsonite production for 2007 was estimated to be about 77 kt (85,000 st), a slight increase from 2006. Gilsonite is an unusual solid hydrocarbon that has been mined in Utah for more than 100 years. Gilsonite is marketed worldwide for use in more than 150 products ranging from printing inks to explosives. All of the gilsonite mines are located in southeastern Uintah County. The three companies that produce gilsonite, in descending order of production, are American Gilsonite, Lexco and Zeigler Chemical and Minerals. Gilsonite production has been increasing modestly during the past several years.

Expanded shale and perlite

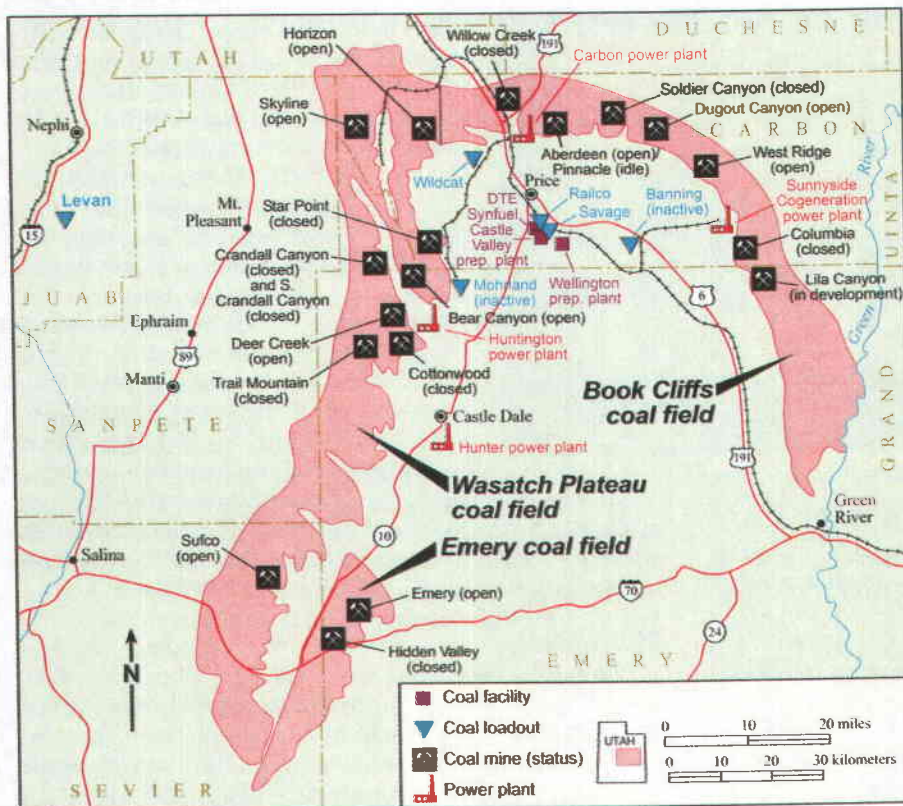
Only one company, Utelite, produced lightweight expanded products from shale for use primarily in the construction and building industries. Mine production was about 181 kt (200,000 st) in 2007, a slight increase from 2006. Utelite's shale plant and mine is east of the town of Wanship in Summit County.

Harborlite Mineral's perlite mine is about 40 km (25 miles) north and east of the town of Milford in Beaver County. The plant is located in Milford. The plant and mine were shut down in mid-2006 and remain inactive.

Harborlite's parent company, World Minerals was sold to Imerys Group, a major worldwide industrial minerals company based in France, in 2005.

FIG. 5

Location and status of central Utah's coal mines and processing plants. Data from DOGM files.



Common clay, bentonite and high-alumina clay

More than 434 kt (478,000 st) of common clay and approximately 57 kt (63,000 st) of bentonite were produced by 10 companies in 2007. Statewide, there were 23 active mine permits held by common clay, bentonite and high-alumina clay operators in 2007. Many of these mines operate intermittently. The two largest producers of common clay in 2007 were Interstate Brick and Interpace Industries (also a brick producer). Two companies (Western Clay Co. and Redmond Minerals) produce bentonite from pits located in central Utah. Sandy Nell produces a high-alumina clay from a pit in Beaver County.

More than 75 percent of all common clay is used in the manufacture of brick. Bentonite is used as a sealant in many civil engineering applications, as a pet-waste absorbent (litter box filler), as a component of oil and gas drilling fluids, and as a binder in foundry molds. High-alumina clays are currently only being used in the manufacture of portland cement.

Gypsum

Five companies produced about 370 kt (408,000 st) of gypsum in 2007, about 96 kt (106,000 st) less than in 2006. In descending order of production, the three largest producers were U.S. Gypsum, Sunroc (Clyde Companies) and Georgia Pacific Gypsum. Georgia Pacific Gypsum and U.S. Gypsum operate the only two wallboard plants in Utah. Both plants are near the town of Sigurd in Sevier County. The Georgia Pacific plant, which closed in 2002, reopened in 2006 and is operating on a full-time basis.

Statewide, there are 10 active gypsum mines. Six reported production in 2007. Most gypsum produced in

Utah is used for making wallboard. But several operators supply raw gypsum to regional cement companies where it is used as an additive to retard the setting time of cement, and to the agricultural industry for use as a soil conditioner. The decreased production of gypsum is likely related to the downturn of the housing industry.

Energy minerals production

Coal

Utah's coal operators produced 22 Mt (24.3 million st) of coal valued at \$574 million from 13 underground mines in 2007 (Figs. 2 and 4, Table 1). This production was 1.7 Mt (1.9 million st), or 7 percent less than in 2006. All of the mines and coal-related facilities are located in east-central Utah (Fig. 5). Utah's synfuel plant, DTE Utah Synfuels the only synfuel facility west of the Mississippi River, is located at the Castle Valley (CV) railroad spur southeast of Price. The plant operated full time in 2007 and processed slightly more than 1.8 Mt (2 million st) of high-ash coal purchased from several local coal operators. The

DTE plant produces a solid synthetic product that is used in cogeneration, industrial and traditional coal-fired power plants. It closed in late December because of the loss of synfuel tax credits.

Covol Technologies' Wellington air-spargue processing plant that began operating in December 2005 continued to process coal during 2007. Covol Technologies is a subsidiary of Headwaters and the plant is rated at about 226 t/h (250 stph). The plant is located just south of the CV spur. Arch Coal's new (2006) Castle Valley coal preparation plant operated on an as-needed basis in 2007, and processed coal from the company's Skyline and Dugout mines. The plant is located along the CV spur and has the capacity to process up to 1.8 Mt/a (2 million stpy) of coal.

The largest coal producer was the Sufco Mine, operated by Canyon Fuel Co. which produced 6.1 Mt (6.7 million st) of coal in 2007. In addition, the following four mines each produced in excess of 1.8 Mt (2 million st) of coal: Aberdeen, operated by Utah American Energy (formerly Andalex Resources); Deer Creek, operated by Energy West Mining (Rocky Mountain Energy); Dugout Canyon, operated by Canyon Fuel and West Ridge, operated by West Ridge Resources.

Following the Crandall Canyon Mine disaster in August 2007, the Crandall Canyon Mine, operated by Utah American Energy Inc. was permanently closed. Utah American Energy's Lila Canyon Mine received all of its required permits late in 2007 and some site work was initiated (Fig. 5). The surge in oil and gas prices that began in the fall of 2003 has positively affected coal prices and production, which are both

anticipated to increase in 2008. Approximately 60 percent of Utah's coal was consumed in state by three electric utilities in 2007.

Exploration and development activity

Mineral exploration and development work increased in Utah again during 2007 due to the continuing increase in world commodity prices from the all-time low in 2001 to the current near record highs. Most efforts in Utah were focused on copper, molybdenum, gold, silver, zinc and uranium. The information in this section is largely derived from numerous individual company Web sites and press releases. The locations of the projects and mining districts discussed below are shown on Fig. 6.

Base metals

Base metals had another strong year in Utah, buoyed by near record metal prices. The Bingham Canyon Mine produced exceptional profits. The Lisbon Valley copper mine produced for a full year. Another copper operation near Milford is poised to begin production in 2008. And exploration is ongoing in numerous other districts across the state.

Bingham Canyon

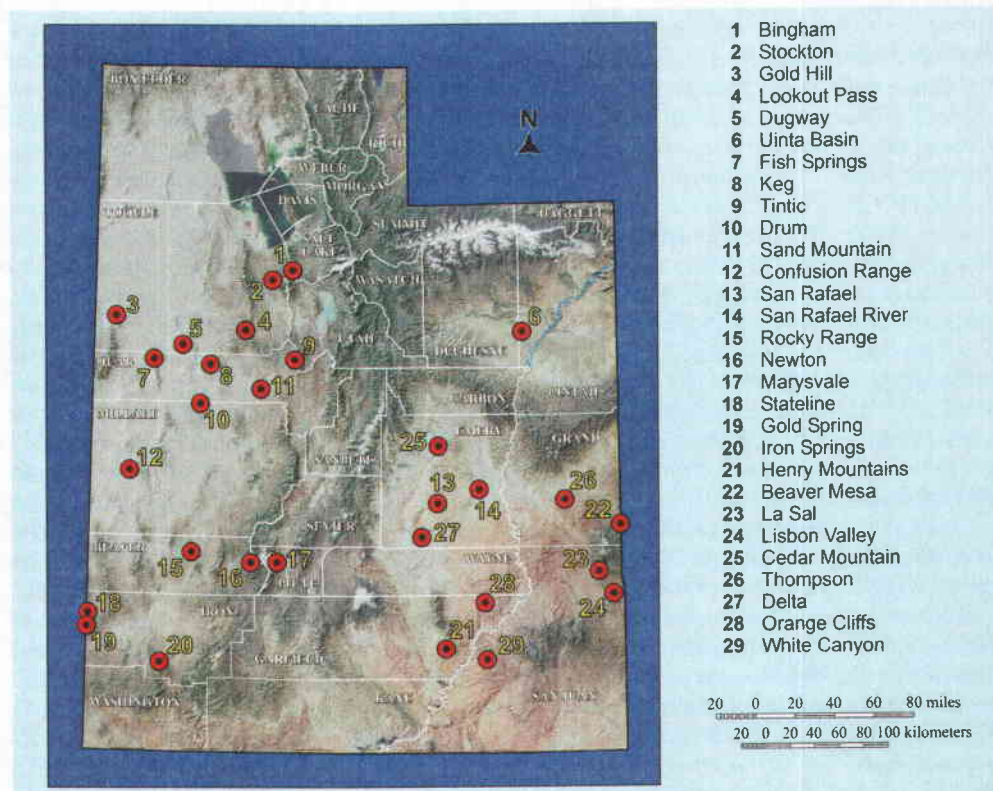
Kennecott Utah Copper's (KUC) Bingham Canyon Mine earned \$1.6 billion in 2007, down slightly from a record \$1.8 billion in 2006, on increased copper, gold and silver prices and a continued strong molybdenum price. Bingham remains the U.S.'s second largest producer of copper and molybdenum. KUC is in the fourth year of an aggressive development program with current efforts concentrated on extending the mine life from the current plan of 2017 to 2036. Alternatives being studied include additional openpit laybacks and/or various underground options. A prefeasibility study of skarn and porphyry targets will be completed in 2008.

Exploration efforts in 2007 included drilling 38 diamond holes totaling 29,000 m (95,000 ft). Significant results included expansion of the known molybdenum and copper-gold mineral resources. Development work at Bingham Canyon included re-excavation of the North Ore Shoot shaft collar, which was buried by the canyon dump, and the driving of a horseshoe-shaped drainage tunnel from near the bottom of the pit to the north and west. The North Ore Shoot shaft will be refurbished in 2008. An \$82-million project at the mill to improve the bulk flotation process, begun in 2004, will be completed in the second quarter of 2008 (Schroeder, written communication, 2008).

Brownfield exploration at Bingham Canyon continued

FIG. 6

Major base and precious metals and uranium exploration districts and areas in Utah in 2007.



with induced polarization (IP) surveying and geochemical sampling southwest of the pit on West Mountain. This work resulted in the recognition of a large phase IP anomaly with coincident copper-gold surface geochemical anomalies. Exploration drilling is planned for 2008.

Lisbon Valley Copper

Lisbon Valley Mining began mining and stacking the leach pads in 2005, and plant construction at the new openpit, heap leach, SX-EW copper operation was completed in 2006. Copper mineralization at Lisbon Valley occurs as disseminated and fracture-controlled copper in Cretaceous sandstones along the nose of a salt-cored anticline. The operation continued to endure startup problems throughout 2007 as it attempted to ramp up to full production. Fundamentally, the recovery of copper from the pads has been substantially slower than anticipated. Despite efforts to increase production, the operation has continued to underachieve, so mining was suspended in early 2008. Approximately 15.8 t (35 million lbs) of copper will have been placed on the leach pads by the time that mining is halted and leaching of this material is expected to continue for the next one to three years. 2007 production was about 9 kt (10,000 st) of copper.

Exploration by Lisbon Valley in 2007 focused on evaluating the Flying Diamond-Stateline resource, discovered under cover a few miles southeast of its openpit operation. Drilling in 2007 included 16 new holes totaling 1,287 m (4,220 ft). These holes were generally laid out in northeast-trending fence patterns perpendicular to the ore-controlling east splay of the Lisbon Valley fault. It helped define a mineralized zone approaching 3,050 m (10,000 ft) long by about 152 m (500 ft) wide and about 15

m (50 ft) thick with grades of approximately 0.4 percent copper. Because of the problems at the mining operation, exploration drilling was suspended in October 2007 (Constellation Copper, 2007).

Rocky-Beaver Lake

Western Utah Copper (WUC) controls about 37,200 hm² (92,000 acres) in the Milford area and has been exploring the Rocky and Beaver Lake mining districts for the past several years. The districts host seven partially defined copper skarn and breccia pipe deposits. Current proven ore reserves total approximately 2.2 Mt (2.4 million st) averaging 1.38 percent total copper with possible gold-silver credits. In 2007, WUC obtained a large mine permit from DOGM, stripped overburden from the Hidden Treasure copper skarn and began construction of a 2.27 kt/d (2,500-stpd) flotation mill (Western Utah Copper, 2007). In January 2008, WUC was acquired by Copper King Mining.

Inland explorations

Inland Explorations was formed in 2006 specifically to conduct base metal exploration in Utah. The company has pursued a grassroots exploration program and has acquired four properties to date: Dugway, Keg, Thompson Knoll and Dunes (Sand Mountain). The most advanced target is a copper-lead-zinc-gold-silver carbonate-hosted replacement deposit on the southwest flank of the Dugway district. Inland has run a detailed aeromagnetic survey, collected 240 surface rock chip samples and drilled 1,144 m (3,752 ft) in four preliminary diamond holes. Surface samples have assayed up to 2.9 percent copper, 10.9 percent zinc, 14.6 percent lead, 285 ppm silver, 12.8 ppm gold and 168 ppm molybdenum. Mineralization at Dugway is associated with high magnetic susceptibilities and a three-dimensional magnetic model will be used to delineate drill targets in 2008.

The target at the Keg property is a porphyry/skarn deposit. Surface rock-chip samples assay up to 4.7 percent copper, 3.8 percent lead, 0.5 percent zinc, 0.26 percent molybdenum, 123 ppm silver and 0.6 ppm gold. Geophysical surveys include a detailed aeromagnetic survey 85 km² (33 sq miles), a spontaneous potential/resistivity survey 3.6 km² (1.4 sq miles), and one long IP line 5.5 km (3.4 miles). Results of geophysics and surface geochemistry indicate several coincident anomalies. A drilling program is scheduled to begin in 2008.

Thompson Knoll lies in the Confusion Range of west-central Utah. The targets there are base and precious metal skarn and sediment-hosted gold similar to that in the adjoining Kings Canyon deposit. Geophysical surveys completed include a detailed ground magnetic survey (20 km² or 8 sq. miles) and several IP lines (16 line km). The ground magnetic survey defined a sizable magnetic high representing a buried intrusive. Surface samples indicate that the intrusive is associated with base and precious metal mineralization, with assays up to 2.2 percent lead, 0.4 percent zinc, 50 ppm molybdenum, 16 ppm silver and 0.8 ppm gold. Combined magnetic and IP/resistivity results suggest a possible skarn target and an area of silicification and gold mineralization. Drilling is planned on both of these targets in the coming year.

A fourth property at Dunes is a base and precious metal massive sulfide replacement target associated with gently dipping structures. Twenty-six surface samples as-

sayed up to 1.3 percent copper, 1.4 percent lead, 0.3 percent zinc, 318 ppm silver and 1.3 ppm gold. Geophysical surveys, including ground magnetic lines and IP lines, are in progress (Venable, personal communication, 2008).

Crypto

Lithic Resources acquired the Crypto zinc skarn in the Fish Springs mining district of western Juab County in 2005 (Lithic Resources, 2007). A 1993 Cyprus Minerals estimate shows a shallow oxide resource of 2.8 Mt (3.1 million st) averaging 7 percent zinc and a deep sulfide resource of 5.4 Mt (6 million st) averaging 8.8 percent zinc.

In 2007, Lithic began a planned 10,000-m (33,000-ft) core drilling program aimed at confirming and expanding the historical zinc resource at Crypto. At the end of the year, five holes had been completed for a total of 1,297 m (4,255 ft) of drilling. Reported intercepts ranged up to 12.2 m (40 ft) of 21 percent zinc oxide; zinc sulfide intercepts of 17.3 m (57 ft) grading 27.3 percent zinc and 30 m (98.5 ft) grading 17.93 percent zinc with minor copper.

Drilling continued through the first part of 2008. Additional targets included an IP anomaly, high-grade silver-lead mineralization in the vicinity of the historic Utah mine and deep molybdenum mineralization associated with the Crypto intrusive. The drill program will be followed by preliminary metallurgical test work and an updated resource estimate (Staargaard, personal communication, 2008).

Stockton

Kennecott Exploration's Stockton porphyry copper deposit, about 16 km (10 miles) southwest of Bingham, was acquired by Geoinformatics Exploration. Stockton hosts a previously estimated resource of approximately 172 Mt (190 million st) at 0.41 percent copper and 0.14 ppm gold beginning at a depth of about 225 m (740 ft). The best previous hole ran 277.4 m (910 ft) averaging 0.39 percent copper and 0.13 ppm gold. Geoinformatics has continued drilling at Stockton (Geoinformatics Exploration, 2007).

Southwest Tintic

Quaterra Resources acquired about 1,300 hm² (3,200 acres) of patented and unpatented mining claims covering the Southwest Tintic porphyry copper system. The property hosts a known resource of approximately 360 Mt (400 million st) of 0.33 percent copper and 0.01 percent molybdenum. Quaterra plans drilling in 2008 (Quaterra Resources, 2007).

Iron Springs

Palladon Iron acquired the Iron Mountain property (former Comstock-Mountain Lion openpit), which hosts an estimated resource of 16 Mt (18 million st) averaging 52 percent iron. The ore occurs as massive replacement/skarn deposits adjacent to Miocene laccoliths. Palladon spent 2007 drilling a series of condemnation/water monitoring holes (558 m or 1,830 ft total) at the future mill site and installing a power substation. The proposed plant is a 2-Mt/a (2.2-million-stpy) mill/concentrator (Palladon Ventures, 2007).

Precious metals

Near record prices for precious metals during the past year significantly increased the level of gold and silver exploration activity in Utah. These efforts are largely

focused in the eastern Basin and Range Province of western Utah.

The Silver Dome property in the southern Fish Springs district has never been drill tested. The 2,023-hm² (5,000-acre) property was acquired by Cordex for Columbus Gold (Columbus Gold, 2007). Silver mineralization at Silver Dome is hosted in flat-lying Ordovician sandstones. Initial work has identified mineralization, typically assaying from 15 to 100 ppm silver, in a zone measuring 1,000 x 100 m (3,300 x 330 ft) along the edge of post-mineral cover. The target at Silver Dome is bulk-minable silver mineralization amenable to openpit development. Several lines of IP were completed this year and a National Instrument (NI) 43-101 report is being prepared. Permitting is in progress for a 27-hole drilling program to begin in May 2008 (Wallace, written communication, 2008).

The Keg project is another silver property acquired by Cordex and Columbus Gold. This 405-hm² (1,000-acre) property covers an area of stockwork quartz veining in a window of quartzite surrounded by Tertiary volcanic rocks and alluvium. Mapping, sampling and a ground magnetic survey have been completed and an excavator trenching program is planned for spring 2008 (Andy Wallace, written communication, 2008).

Dumont Nickel continued its exploration efforts in the Gold Hill mining district in southwestern Tooele County. The Rattler project, a sediment-hosted gold system on the northwestern portion of Dumont's property, was tested by five holes totaling 233 m (765 ft) in 2007. The best hole cut 16.8 m (55 ft) of calcareous siltstone averaging 0.23 ppm gold (Dumont Nickel, 2007).

Maestro Ventures acquired the Kings Canyon sediment-hosted gold property in southwestern Millard County. The property was explored in the early 1990s, primarily by Crown Resources. The property contains several gold zones with the largest defined resource holding about 6.2 Mt (6.8 million st) averaging 1 ppm gold. Maestro completed 463 m (1,518 ft) of confirmatory core drilling in a five-hole program. The best hole (KCC07-02) included an interval of 15.5 m (51 ft) averaging 1.02 ppm gold (Maestro Ventures, 2007).

Grand Central Silver Mines drilled 13 reverse-circulation holes totaling 5,262 m (17,265 ft) on a 46-hm² (114-acre) tract on the western fringe of the Bingham mining district in 2006-2007. The best drill intersection was 7.6 m (25 ft) of 2.06 ppm gold. A NI 43-101 technical report is pending.

Copper King Mining initially acquired about 486 hm² (1,200 acres) of mostly patented mining claims in the Drum (Detroit) mining district, historically one of the largest gold producing districts in Utah. Copper King later acquired an additional 445 hm² (1,100 acres) of unpatented claims in the district through the merger with WUC, giving Copper King a large land package including some previously defined small gold resources.

Uranium

The dramatic rise in the price of uranium since 2001 has substantially impacted exploration and development activity in Utah. Historically, Utah has been the third largest uranium producing state. The majority of the uranium work in Utah has focused on the Colorado Plateau (Gloyn and others, 2005), where the Pandora Mine, near La Sal, was the first mine to reopen. The following

paragraphs report the major uranium events in Utah in 2007.

Denison Mines owns the White Mesa uranium mill near Blanding, the Pandora Mine and the Henry Mountains mining complex. These properties were acquired from International Uranium in late 2006. In 2007, the 1.8-kt/d (2,000-stpd), dual-circuit (uranium-vanadium) White Mesa mill continued processing alternate feed nuclear waste materials, while ore from the Pandora Mine was trucked to the mill and stockpiled. The company began a \$21-million upgrade to the mill, which is expected to produce more than 1.36 kt (3 million lbs) of U₃O₈ and 2 kt (4.5 million lbs) of V₂O₅ annually by 2010. The mill is expected to switch from alternate feed waste material to ore in early 2008. The mill is also accepting ore from other companies for toll milling.

In late 2006, Denison's Pandora Mine, in the eastern La Sal district, resumed uranium production. In 2007, Pandora produced approximately 32.6 kt (36,000 st) of ore, which was shipped about 110 km (70 miles) south to the White Mesa mill. Reserves at the Pandora Mine are estimated at 263 kt (290,000 st) at 0.22 percent U₃O₈.

Denison Mines' Henry Mountains Complex (Tony M Mine and Bullfrog properties) in the Shootaring Canyon district host the largest known uranium resource in Utah, estimated at about 2.9 Mt (3.2 million st) averaging 0.28 percent U₃O₈ and an existing stockpile of 200 kt (220,000 st) of 0.138 percent U₃O₈. The mine is being rehabilitated while the final permits for the mining operation are pending from the U.S. Bureau of Land Management. Mining is scheduled to resume in 2008 and production is expected to ramp up to about 9.1 kt/m (10,000 stpm) (Denison Mines, 2007).

Energy Fuels, Inc. is exploring and rehabilitating other historical uranium mines. The Whirlwind Mine on Beaver Mesa along the Utah-Colorado border about 45 km (28 miles) northeast of Moab, is scheduled to begin producing in 2008 (Energy Fuels, 2007). This is an interesting operation because, while much of the underground mining occurs in Utah, the portal and surface facilities are a mile to the east in Colorado. The Whirlwind resource is about 149 kt (164,000 st) of ore averaging 0.2 percent U₃O₈ and 0.66 percent V₂O₅. Energy Fuels anticipates mining 180 t/d (200 stpd).

Energy Fuels also acquired the 284-hm² (702-acre) Hecla shaft property near La Sal in 2007. The renamed Energy Queen Mine has an estimated resource of 161 kt (178,000 st) of ore averaging 0.22 percent U₃O₈ and 0.86 percent V₂O₅, and an existing 229-m (750-ft), lined shaft. Rehabilitation is under way for a 180-t/d (200-stpd) operation starting in 2008.

Uranium One acquired the uranium assets of the U.S. Energy in 2006 and Energy Metals in 2007. The properties include the Velvet property, 210 kt (231,000 st) averaging 0.43 percent U₃O₈ in the Lisbon Valley district; Frank M resource, 1.36 Mt (1.5 million st) averaging 0.12 percent U₃O₈ in the Shootaring Canyon district; San Rafael property, 587 kt (647,000 st) averaging 0.16 percent U₃O₈ in the Green River area, and the Sahara Mine 99 kt (109,000 st) averaging 0.23 percent U₃O₈ in the San Rafael River uranium district.

Uranium One also owns the Shootaring Canyon (Ticaboo) uranium mill in the Henry Mountains district. This 680-t/d (750-stpd) mill is currently being repermited for operation (Uranium One, 2007). ■